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ROCKS and MINERALS

A Magazine for Mineralogist, Geologist and Collector . . .

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OCTOBER, 1938

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THE ROCKS AND MINERALS ASSOCIATION

PEEKSKILL, N. Y.

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Organized in 1928 for the increase and dissemination of mineralogic knowledge.

To stimulate public interest in geology and mineralogy and to endeavor to have courses in these subjects introduced in the curricula of the public school systems; to revive a general interest in minerals and mineral collecting; to instruct beginners as to how a collection can be made and cared for; to keep an accurate and permanent record of all mineral localities and minerals found there and to print same for distribution; to encourage the search for new minerals that have not yet been discovered; and to endeavor to secure the practical conservation of mineral localities and unusual rock formations.

Ever since its foundation in 1928, the Rocks and Minerals Association has done much to promote the interest in mineralogy. It has sponsored outings, expeditions, formations of mineralogical clubs and the printing of many articles that have been a distinct contribution to mineralogy.

Those of our readers who are members of the Association can rightly feel that they too were sponsors of these many achievements that have helped to give mineralogy a national recognition. Among your friends there must be many who would like to have a part in the Association's work—to share with you the personal satisfaction, the pleasure, and the benefits of membership. Will you give your friends this opportunity to join the Association by nominating them for membership?

Each new member helps to extend the Association's activities—helps to make your magazine larger,better, and more interesting, and above all assists in the dissemination of mineralogical knowledge.

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Mineralogical clubs which subscribe for **Rocks and Minerals** also become affiliated members of the Rocks and Mineral Association and enjoy all the advantages which such an affiliation affords.

A number of clubs hold membership in the Association, participate in the annual outings, and co-operate in many ways in furthering the aims and ambitions of the Association.

Affiliation with the world's largest mineralogical society cannot fail to increase membership, enlarge circles of acquaintanceship, and stimulate a keener interest in mineralogy.

A list of affiliated clubs will be found among the back pages of the magazine.

ROCKS and MINERALS

PUBLISHED MONTHLY

Edited and Published by PETER ZODAC

OCTOBER 1938

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The Official Journal of the Rocks and Minerals Association

CHIPS FROM THE QUARRY

PETER ZODAC

You, and the Prize Article Contest

We are again calling attention on another page of this issue of **Rocks and Minerals** to the PRIZE ARTICLE CONTEST. This is the last call. The time for submitting manuscripts closes October 15th. We should like to have every member of the Rocks and Minerals Association eager to secure one of the awards offered. We would not regard such a unanimous entry as being so much a desire for the money itself as an interest in mineralogy and the loyalty to a locality which the writer has loved and which he wishes to honor for the specimens it yielded him or the pleasure he had experienced in searching for its treasures, great or small.

There are only three prizes but possibly among the manuscripts submitted there may be those worthy of printing in **Rocks and Minerals** among which could be yours. It will be our privilege to receive from the judges all such non-winning articles as they may think suitable for our columns. And if you do not win a prize at least you have had the experience which may be of help to you in entering any other contest which may be fostered by **Rocks and Minerals.**

On the other hand, is it not worth striving for to secure one of the three prizes offered? The money could be converted into handsome specimens you long have wished to possess; in books you would like to add to the mineralogical shelf of your library; to be applied to the purchase of a fluorescent light, specimens, or special want which could be gratified at once without affecting your income materially. Or it could be applied to the gratification of some other wish you would like to have fulfilled.

You never know what you can do until you try. You may be uncertain as to the subject you could choose. In that event let us suggest you select for your subject your favorite locality; a noted locality in your neighborhood, if it has not previously been written up; your favorite species of minerals with what you may know about them, the forms they take, the minerals with which they associate, or you might write up a mineralogical trip that meant more to you than any other you have enjoyed, with the reasons for it, or choose something which you think makes a most popular appeal and excites a general interest in minerals, remembering, however, that in all of our suggestions some scientific appeal of what is being discussed must be included.

Read carefully the rules of the contest for they will govern the judgment of your article.

Peter Zodac

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WHOLE NO. 87

TILLY FOSTER UP-TO-DATE

By JOHN N. TRAINER

Two and three generations ago, the Tilly Foster Mine was at its height of fame as a source of rich magnetic iron ore and of beautiful minerals but it has not been operated for forty years and today is filled with water. Only the huge dumps remain as a hunting-ground for mineralogists.

It was named for a Mr. Tilly Foster who owned the farm on which the ore was discovered about 1810 and not, as many suppose, for a lady by the name of Matilda Foster. It is in Putnam County, New York, on the Putnam Division of the New York Central Railroad and on highway Number 6, less than two miles West of Brewster.

The minerals of this locality are my specialty. The mine is only a few miles from my Summer home. My chauffeur drops me out of the car at the gate of the property and returns at an appointed time to pick me up, glad enough to have me out of the way while she goes about her housewifely duties or plays bridge at the neighbors.

It was not until November, 1935, that I became actively interested when in London and a frequent visitor at the South Kensington Museum where I saw the labels; "Tilly Foster Iron Mine at Brewster's, New York, U.S.A." under chondrodite, sphene, clinochlore, and other minerals. I was reminded that here was a convenient field in which to specialize. In 1936, when we went to Brewster for the Summer, I began to collect and kept it up for three or four hours nearly every week-end and have repeated the schedule to date (August 1938). I have spent about 100 hours all told at the mine and have carried away hundreds of specimens of which less than 150 were worth keeping, and have spent as many hours again on home and night work.

Many collectors said that there was little of interest to be found at Tilly Foster, that the dumps have been worked to death and that nothing good has come from them for a long time. That is largely true. But I buy and trade as well as collect on the ground and there are still many good specimens to be found as this paper will attempt to show.

Buying Tilly Foster specimens is like collecting antiques; you must wait for "something to turn up". There is a good reason. This is an old mine which reached its peak of production about 1870 and was abandoned in 1897. The best material came out during operations and is now in museums and old collections; it can not be found on the dumps today.

Present Conditions

For several years a crushing plant has been making road material from the dumps. In the fore part of the Summer of 1936, the steam shovel sent miscellaneous rock to the crusher with much dirt and a man was stationed at the belt from the cracker to throw off the black, green and white material among which some good specimens were found. In the latter part of the summer, the methods were changed and the large pieces of syenitic gneiss were broken up with dynamite before going to the plant. This

rock was the cap which was removed when the mine was opened to the sky in 1837-88-89. Some good material was found in this rock and the fact that a lot of it went through the plant during the week days was distressing.

During the summer of 1937, the plan of operations was for the steam shovel to push aside the big pieces and to send to the plant only those it could handle. The operator was very selective as to the banks worked and very few minerals were found by following him.

My best finds have come from the dumps away from the plant in a broad area. This has naturally been worked many years by collectors and there is seldom anything good on the surface except after heavy rains, but implemented with a rake, a shovel, a brush for cleaning, and a one-legged stool, I dig into the banks like a dog after a woodchuck. Collectors on an old dump know what this work is like especially on a hot summer day. A stream of water from a hose would be the ideal implement.

Any vein material covered with dolomite, serpentine, brucite, hydrotalcite or calcite is worth investigating because when freed of these you may find good chondrodite, clinochlore, muscovite, magnetite, and other crystals.

A Locality Collection

There are two primary objects in making a locality collection; first to get specimens of every possible species and variety and second, to get the best possible specimens of each. Such a collection is not showy. There are a great many minerals which come better from other localities and which a general collector would not have in his cabinet. For instance my albite crystals are tiny but they will stay in the collection until larger and better ones are found.

The first task was to compile a list of all the minerals ever found at Tilly Foster from "The Minerals of New York and Environs", page 94, from published articles and papers, from statements by other collectors, from what is in old collections and what I have myself collected on the ground.

The most useful articles are by E. S. Breidenbaugh in 1873, followed in 1874 by J. D. Dana on pseudomorphs, by E. S. Dana in 1875-76 on chondrodite, by Samuel Levis Penfield and W. T. Howe on the same subject in 1894, by Otto Mugge in 1903 and Axel Hamberg in 1904 on the serpentine pseudomorph after periclase (?) and lastly by Austin Flint Rogers in 1929 on polysynthetically twinned dolomite. There are several articles on the history, geology and mining operations of the locality covering a long period. At the end of this paper is a list of references.

There have been found at Tilly Foster fifty-five species of minerals, nineteen varieties, nineteen serpentine pseudomorphs and eight miscellaneous pseudomorphs. The full list is given below. Those in **bold face type** are new to the records of this locality.

Albite
Amphibole-actinolite
Amphibole-actinolite-byssolite
Amphibole-hornblende
Amphibole-hornblende-pargasite
Amphibole-Tremolite
Apatite
Apophyllite
Aragonite
Arsenopyrite
Autunite
Biotite
Brucite
Calcite
Chalcopyrite
Chondrodite
Chondrodite-pseudo after dolomite
Chrysocolla
Chrysolite (olivine)
Clinochlore (ripidolite)
Clinohumite
Datolite
Dolomite
Enstatite
Enstatite Bronzite
Epidote
Fluorite
Garnet
Gypsum-selenite
Hematite
Hisingerite
Humite
Hydromagnesite

Hydrotalcite
Ilmenite
Kaolin—pseudo after serpentine
Laumontite
Limonite
Magnesite
Magnetite
Malachite
Marcasite
Microcline
Molybdenite
Muscovite
Oligoclase
Opal
Phlogopite
Prehnite
Prochlorite (ripidolite)
Pyrite
Pyroxene
Pyroxene-augite
Pyroxene-Hedenbergite-coccolite
Pyroxene-diopside
Pyrrhotite
Quartz
Quartz-milky
Quartz-smoky
Quartz-rose
Serpentine
Serpentine-bowenite pseudo after clinochlore
Serpentine-chrysotile
Serpentine-marmolite
Serpentine-picrolite
Serpentine-precious
Serpentine-retinalite
Serpentine-williamsite
Spinel
Stilbite
Talc
Talc-pseudo after pyroxene
Talc-soapstone
Titanite
Tourmaline
Zircon

Pseudomorphs

Brucite after dolomite
Chondrodite after dolomite
Dolomite after chrondodite
Calcite after aragonite
Kaolin after serpentine
Magnetite after chondrodite, dolomite and others
Pyrrhotite after serpentine
Serpentine after amphibole-actinolite
Serpentine after amphibole-hornblende
amphibole after pyroxene
anhydrite—(?)
anthophyllite
apatite
biotite
brucite
calcite
chondrodite
chinochlore
dolomite
enstatite
fluorite
hydrotalcite
magnetite
muscovite
periclase—?
pyroxene
Talc after pyroxene

Additions To The List

The minerals **in bold face type** in the above list consisting of 16 species, 17 varieties, 8 serpentine pseudomorphs and 3 miscellaneous pseudomorphs, are new to the Tilly Foster records and therefore will be described first. It must be explained and emphasized that this means in some cases new **only** to the records. Take byssolite as an illustration; it is in old collections with faded labels that must be fifty years old but there is no reference to it in the Tilly Foster literature unless it was intended to come under Actinolite.

Amphibole, of which the four minerals below are varieties, is nowhere mentioned in the records. Actinolite is the only amphibole mentioned.

Amphibole-byssolite. In the American Museum of Natural History this fibrous gray mineral is associated with apatite but in my four specimens, three purchased, it is associated with magnetite and in one case with actinolite. In 1934, Mr. T. Lipton Hart Smith of Danbury, Connecticut, found a fine specimen associated with slender actinolite and small magnetite crystals. I have found only one specimen on the dumps and believe it is scarce.

Amphibole-hornblende. Two searchers in the records have failed to find mention of this mineral although very common at this locality in large cleavable black and green masses and in crystalline form.

In crystals it is not common. In 1936, I found a good group of three crystals, two of them one inch long by a half inch; on massive hornblende and imbedded in calcite. Mr. H. Alban Anderson of Peekskill, New York, has a similar group except that his is with epidote. Mr. Wilbur J. Elwell of Danbury Connecticut, has black, acicular crystals of good quality in quartz. Masses of thin fibrous black hornblende can be found, sometimes grading into coarse crystalline.

Amphibole-pargasite. There is some doubt about the identify of this mineral which I found in 1937. It is a vein of acicular crystals between magnetite and brown serpentine—pale green, stained brown, probably by limonite. It is not common

Amphibole - tremolite. Grayish-green, tough, massive tremolite, as a six inch vein in clinochlore schist, was found by Mr. R. Emmet Doherty of Peekskill, New York, in May, 1937, and a few weeks later by the writer in large masses which had been broken by blasting. It takes a good polish but is a bit soft. It is not common. It has been recently described in ROCKS and MINERALS[1].

Aragonite. This was found by Mr. Zodac in 1935 as grayish white incrustations, fair in quality, on bronzite, magnetite and other minerals and by the writer in 1937 as gray tapering slender crystals on serpentine apparently similar to the specimens from Franklin, New Jersey, and Frizington, England, and in radiated groups of crystals on massive magnetite. It is not common.

Arsenopyrite. Steel gray specimen, 2 x 1½ x ½ inch, group of flattened twin crystals. Found by the writer in 1936; none since. Scarce.

Autunite. A small specimen of this mineral, as a yellowish coating on gneiss, was found in December, 1935, by Mr. Joseph P. Linneman of Buffalo, New York. This autunite and some yellow calcite described later are probably the only minerals at Tilly Foster which fluoresce.

Chondrodite pseudo after dolomite. A half rhomb on massive chondrodite. Found by the writer in 1937.

Chrysocolla. This material, with malachite and both occurring as stains of poor quality on a bronzitic rock, was found in 1931 by Mr. Ernest Weidhaas of Pelham Manor, New York. Scarce.

Enstatite-bronzite. It is strange that there is no mention of bronzite in the literature and records about Tilly Foster minerals because there are at least a dozen large masses of it in the dumps today and plenty of small pieces. Perhaps the word "enstatite" was meant to include it or possibly the enstatite has bronzed in the many years of exposure since it was thrown on the dumps. The masses in general are coarsely crystalline, dark green in color, wth only the surfaces bronzed and very tough. Some of the finest, lustrous material is in small pieces in the ground with one face exposed. These exposed faces are more lustrous than the faces of the large masses above ground. It has been recently described in ROCKS and MINERALS[2].

Gypsum var. selenite. Minute, colorless, lath-shaped crystals on apophyllite found in July, 1937 by Mr. Zodac. Probably rare.

Hematite. Small reddish stains on serpentine and coatings on microcline. My specimen is interesting because it was probably formed by frictional heat in the kind of a slide which resulted in the death of many miners years ago and which acounts for the "slickensided" serpentine, calcite and fluorite found here.

Hisingerite is an amorphous brown hydrated ferric silicate of uncertain composition on massive magnetite found by me in 1937. On one specimen is grayish white opal and on another serpentine after fluorite in octahedral form.

Ilmenite. A flat tabular crystal, with tourmaline, in gneiss, found by me in 1936. Another on calcite was found this year.

Kaolin. Pseudo after serpentine, "kaolinized serpentine", easily mistaken for white serpentine, found by me in 1936.

Limonite. This mineral is common, as might be expected at an iron mine, as stains and coatings on various minerals;

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[1]*Some recent finds at Tilly Foster.* By Peter Zodac, ROCKS AND MINERALS, June, 1938, p. 180.

[2]*Some recent finds at Tilly Foster,* p. 180.

so common and uninteresting perhaps that it was not worth listing. One of my specimens is botryoidal.

Malachite. In small well colored masses associated with brucite and hematite, as a crust on chalcopyrite and stain on chrysocolla. These are recent finds by Mr. Weidhaas and the writer.

Microcline. Plentiful in flesh-colored masses in pegmatite associated with actinolite, hornblende and other minerals. A friend has given me a white specimen, resembling moonstone found recently by him. Although microcline has not been rcorded it is quite possible that the "orthochase" mentioned by J. D. Dana in 1874 is the same mineral and, in that case it is not properly listed here as new.

Oligoclase. A brown and yellowish, laminated mass 3 x 2 x 1½ inches associated with magnetite and actinolite was found by the writer in 1936.

Opal. Small grayish white coating on hisingerite as mentioned above. Found by the writer in 1937.

Phlogopite. Plates on serpentine and partly altered to the latter mineral. Specimen 2½ x 2 x 1 inches. Found by the writer in 1937.

Pyroxene-augite. It is odd that augite is not mentioned in the records because there is a specimen, with pyrrhotite, in the New York State Museum and I have found it on the dumps. Perhaps it is supposed to be included under the heading Pyroxene.

Pyroxene-diopside. There is plenty of diopside at Tilly Foster—in green granular laminated and crystalline masses, and in black cleavages. The short stout dark green crystals in serpentine, dolomite and calcite are not so easily found. In 1937, I found it as colorless and pink crystals which are uncommon if not rare and which I believe are new to Tilly Foster. In one specimen, a surface of syenitic gneiss three by six inches is covered with slender bristled colorless quarter-inch crystals. In another, on serpentine, two by three inches, the crystals are stouter, lie in all directions, and many are tinted pink. Under a lens they are very pretty. It took several weeks to identify this mineral. At first it was thought to be a rare form of enstatite and hopes ran high only to be dashed when it was finally determined at Harvard to be diopside. The crystals when found were almost completely covered with calcite which was removed with acid.

Quartz—smoky and rose. When the records say that quartz has been found at Tilly Foster without mentioning varieties, one may assume that milky quartz is meant because that is what can be found there today in large quantities. Clear and smoky crystals and masses and rose quartz are seldom found which is surprising and worth noting. Small clear crystals were found by Breidenbaugh years ago and I have picked up a few of them in biotite. Mr. Anderson of Peekskill, New York has a smoky quartz crystal, one-half inch on massive smoky quartz associated with epidote and hornblende and I have found three on biotite one of white is etched left-handed on one face. I have a "combination" specimen, 5 x 2½ x 1½ inches, showing massive smoky quartz, with pink calcite and good epidote crystals all in a vein in biotite.

Serpentine-bowenite. Like quartz no varities of serpentine are given in the records and one may assume that only common serpentine is meant. I found this bowenite in 1936. It is a pseudomorph after a clinochlore crystal, 1½ inches wide, and is associated with magnetite.

Serpentine-chrysotile (asbestus) has been found by Mr. Elwell of Danbury in two minutely thin veins in precious serpentine. I found a specimen in 1937, 3 x 3 x 2 inches, showing five veins, one of them a half inch thick, in very dark green massive serpentine; and several less interesting specimens. Fairly common.

Serpentine-marmolite. Reported by Mr. Zodac. It occurs in a number of colors and shades from greenish-white to green and bluish. Excellent specimens of this thinly foliated serpentine are plentiful. It occurs associated with calcite and clinochlore and often appears to be striated and commonly encrusts magnetite and other minerals ⅛ inch thick. At the New York State Museum two marmolite specimens are displayed;

one green and slickensided; the other mottled red and green.

Serpentine-picrolite. My two best specimens are 10 x 3 x 2 inches and 6 x 6 x 2 inches, one of which has aragonite on it. Mr. Anderson has a good specimen and there are two specimens in the New York State Museum. This is a case of a mineral new to the records but certainly not new to Tilly Foster and it is fairly common.

Serpentine—precious. A good specimen was found by Mr. Elwell of Danbury Connecticut in 1933 associated with magnetite and chrysotile.

Serpentine—retinalite. Yellow, reported to have been found by Mr. Elwell in 1929.

Serpentine—williamsite. There is a 2 x 2 inch dark green polished specimen in the New York State Museum.

Talc—soapstone. Specimen 4 x 3 x 2 inches found by me in 1937, associated with dolomite and showing thin veins of chrysolite.

Talc—pseudo after pyroxene. Two specimens one inch square, found by me in 1937.

Zircon. In 1934, Mr. Ernest Weidhass found a brown zircon crystal, 1-1/5 inches long in a matrix of clinochlore and hornblende, and Mr. John A. Grenzig has also reported finding a small crystal. Undoubtedly rare at Tilly Foster.

Serpentine Pseudomorphs.

Serpentine is very aggressive in taking other forms at Tilly Foster having been found after 17 species out of a possible 55 or nearly one third. J. D. Dana, in 1874, listed and described eleven. There are eight to be added to his list which have come to my attention as follows:

After Actinolite, light green, in Mr. George E. Ashby's collection, an old specimen. I have also found a small specimen on the dumps.

After Amphibole after pyroxene, (serpentine after amphibole in the form of pyroxene), specimen 2" x 2", dull green, found by me in 1937.

After Anthophyllite, gray-green, an old specimen in Mr. Ashby's collection, interesting because the original mineral has never been reported from Tilly Foster. I have found several pieces of this pseudomorph.

After Fluorite, small milky white octaherdra on hisingerite, found by me in 1937.

After Hydrotalcite, light green, group of plates, found by me in 1937.

After Magnetite—on display at the New York State Museum.

After Muscovite, dull green group of small crystals up to ⅜ inch in length associated with brucite and dolomite; found by me in 1937.

After Pyroxene, dark green, associated with magnetite and chondrodite in several specimens found by me in 1936-37.

So much for the "**new**" Tilly Foster minerals. Now let us turn to

The Old Tilly Foster Minerals

Last February, there were on display at the American Museum of Natural History the following number of specimens from Tilly Foster:

Chondrodite—33
Serpentine—22
(nearly all pseudomorphs)
Clinochlore—18
Sphene—9
Brucite—8
Apatite—5
Magnetite—4
Pyrrhotite—2
Fluorite—2
Calcite—2
Garnet—2
Molybdenite—1
Amphibole—1
Datolite—1

This list shows approximately in order the most important and interesting Tilly Foster minerals. Chondrodite, serpentine, clinochlore, sphene and brucite are the ones which have made the locality famous. They are in museums and fine collections all over the world. They will be briefly described in the following alphabetical list of the old Tilly Foster minerals:

Albite, a component of the syenitic gneiss of this district is plentiful in masses and cleavages but crystals are scarce. I have a group of very small crystals in

biotite.

Amphibole—actinolite. The commonest form is a curved aggregate of dark green fibrous crystals, associated with magnetite, microcline, pyrrhotite, etc., and in gneiss. Good, slender dark green crystals are found imbedded in byssolite, dolomite, magnetite and bronzite. One of my specimens, 2 x 2 x 1 inches, is chiefly green actinolite, with tourmaline and biotite on calcite, and another is a thin aggregate, 4 x 1 inches, of long light green crystals with tremolite.

Apatite. The specimens at the American Museum of Natural History are clear green and very beautiful, associated with magnetite, byssolite and calcite. Apatite has been found massive in hornblende and magnetite and as small crystals with chondrodite in calcite and in gneiss. I have looked for it for three years without success. Scarce.

Apophyllite. Fine crystals in gneiss have been reported by Mr. Whitlock and have been found by the writer and others. They are not common. The crystals are white or colorless.

Biotite is common as a constituent of schist, in gneiss, in large aggregates, and as flakes on hornblende. Occasionally crystals, one inch across can be found, almost always curved. I have it as rosettes on albite in gneiss.

Brucite. Anyone is lucky who can find this mineral today in crystal form as you see it in the American Museum of Natural History. I have looked for it in vain for three years. The last find of that nature was by Mr. Elwell in 1933—a group, 2 x 4 inches of ¾ inch crystals imbedded in solid brucite. It is rare as columns in veins in rock, but it is common as thin pearly white crusts or scales on massive chondrodite and clinochlore, often weathered brown and therefore apt to be overlooked.

Calcite is plentiful in masses and as coatings but not common as crystals. The coatings frequently cover crystals of magnetite, chondrodite, etc. and should always, for that reason be treated with respect. Small good crystals are found on massive calcite and clinochlore. I have never found the scalenohedral and nail head groups with brucite and dolomite reported by Mr. Whitlock but have bought a handsome group of scalenohedrons. The specimens which I have found are: small brown crystals in light green serpentine, plates formed at high temperatures, salmon colored rhombic cleavages, and white slickensides; also columnar, yellow, fluorescent pale green in the argon light and with autunite mentioned above the only two fluorescent minerals from Tilly Foster.

Chalcopyrite. In 1934, a fine specimen, pure, massive, 3 x 3 inches was found by Mr. Watson G. Crossman of Peekskill. It has been found as a large mass in gneiss, in small masses in pyrrhotite and in specks and streaks in other minerals. Rather scarce.

Chondrodite. This is the finest mineral from Tilly Foster, in deep garnet red crystals with brilliant luster, up to one inch in width, on massive magnetite, clinochlore and chondrodite. There are more specimens of it on display at the American Museum of Natural History than of any other mineral from the locality. The finest came from narrow veins, 2 x 3 inches, with magnetite and chondrodite crystals covered with dolomite, serpentine, brucite, calcite, etc. Crystals are also yellow and opaque brown. Dana says crystals of great beauty and variety are abundant; at this later date that statement should be amended to "were" abundant because after two years of search, I have found very few and only fair crystals. The fine crystals are "antiques" for which you pay fancy prices.

In massive form chondrodite certainly is abundant. You can find tons of it, brown, yellow and red.

The "yellow ore" of the active mining days is about half yellow chondrodite and half magnetite. Chondrodite is the principal gangue material of the ore at Tilly Foster, making it easy to work and in this respect is unique. The only other mine in the East where this same mixture exists is at the Mahopac Mine about ten miles west of Tilly Foster.

The "blue ore" is chondrodite altered to serpentine mixed with magnetite.

Small masses and grains of chondro-

dite, with spinel, in calcite is abundant. This is the limestone of the district which is of interest to the geologsts.

Chrysolite (olivine), almost colorless, has been reported by R. J. Colony in the New York State Museum Bulletin, September-October, 1921, but so far I have not seen it on the dumps.

Clinochlore. The very fine crystals with chondrodite in gneiss, mentioned by Mr. Whitlock and on display (18 specimens) at the American Museum of Natural History, are probably a thing of the past but nevertheless this is the commonest chlorite at the mine today and I have collected dozens of specimens, some of them quite good. They are assciated with magnetite, serpentine, chondrodite, pyroxene, brucite, hydrotalcite, etc. and were mostly in the material thrown off the belt leading from the cracker to the crushing plant.

In some doubt, ripidolite is mentioned at this point. It has been reported by Mr. J. A. Grenzig. I have found some specimens at the same spots and with the same associations as clinochlore.

Clinohumite. Dana says it is found here in rare but highly modified crystals and Mr. Whitlock says in fine deep red crystals with magnetite and clinochlore in gneiss; but I have never found it.

Datolite. The one specimen on display at the American Museum of Natural History is about 1 x 2 inches, tinted green, in gneiss. I have never found it.

Dolomite. The fine specimens, according to Mr. Whitlock, are associated with magnetite and chondrodite in gneiss. In cleavable gray masses, it is plentiful and good rhombs can be found. It has been found, white and crystallized in a small pocket in a thin white vein of massive dolomite traversing a rock composed of magnetite, clinochlore and serpentine. Mr. Zodac has a 12 x 12 inch cleavable mass penetrated by thin sheets of grayish blue serpentine pseudo after clinochlore. I have found rhombs of dolomite which are polysynthetically twinned as described by Austin Flint Rogers in The

CLINOCHLORE, XLED.
Tilly Foster, N. Y.
(American Museum of Natural History Collection)

American Mineralogist, Volume 14, 1929, and also a rough hexagonal prism, 3 x 2½ x 2 inches, penetrated on one face by brownish-red chondrodite.

Enstatite. This subject has been partly covered under bronzite above. Mr. Whitlock says it has been found as fine specimens with chlorite in gneiss. J. D. Dana, in 1874, writes of enstatite in long fibrous masses and in cavities which bristled with fibrous masses of it. I have looked for it in this form and would say it is difficult to find.

The common enstatite at Tilly Foster, in large quantities, is coarsely crystalline, lamellar, gray and olive green with lustrous faces.

Epidote in masses and crystals is not hard to find, in gneiss and associated with calcite, biotite, smoky quartz, pyroxene, hornblende and dolomite. Dark green crystals up to an inch long, with terminations broken have been found by several collectors in recent years.

Fluorite. Small purple crystals as crusts on masses of clinochlore are common and are attractive and the same on slickensided serpentine has been found. The small colorless crystals are less common. Two of my finds are interesting. One is a group of amethystine octahedral crystals on white crystals, covered originally with calcite. The other is a purple slickensided mass with clinochlore.

Garnet. The oil-green dodecahedral crystals of garnet described by Dana and on view at the American Museum of Natural History have not been found by any collector in recent years. They are undoubtedly scarce.

Humite, described as large partly altered crystals by Dana and as fine deep red highly modified crystals with magnetite and clinochlore in gneiss by Mr. Whitlock have not been found in recent years. There is a reddish brown half inch crystal on view at the New York State Museum.

Hydromagnesite. In an article in the American Journal of Science, written in 1874, J. D. Dana, reports thin chalky crusts or white coatings of this mineral on serpentine associated with brucite. I have never found it.

Hydrotalcite. Described as white and fibrous by Mr. Whitlock. My specimen is grayish white, foliated and laminar, associated with amphibole.

Laumontite. Good groups of white crystals found in veins in gneiss by Mr. Leo N. Yedlin and the writer in 1936 and 1937. Somewhat scarce.

Magnesite. I have found only one specimen, a small group of white crystals and cleavages, difficult to distinguish from dolomite, in a vein, associated with talc and mica.

Magnetite. This is the reason for the existence of the Tilly Foster Mine and it can be found massive today on the dumps by the ton, associated with chondrodite as described above, with serpentine, clinochlore, dolomite, calcite, actinolite and byssolite. Good crystals can ocasionally be found. One of mine is a half inch dodecahedron covered originally with calcite. Others are groups of fine striated octahedrons and dodecahedrons on massive magnetite, also covered originally by calcite.

Marcasite. Listed in "The Minerals of New York and Environs" but not reported as found in recent years.

Molybdenite. Small specimens are occasionally found in hornblende, bronzite, pyrrhotite, dolomite, with magnetite, serpentine and chondrodite.

Muscovite. Rather scarce, but it can be found in large plated aggregates and books and as colorless scales in the gneiss. I have an interesting specimen, 2 x 4 inches, with crystals irregularly placed on edge as is the habit of clinochlore, on mica schist. The crystals were originally covered with serpentine.

Prehnite. Mr. Whitlock has reported it in gneiss but it has not been found in recent years.

Prochlorite can be found in gneiss with clinochlore, in dark green, six-sided tapering crystals and is, I believe, ripidolite; and in scaly bright green aggregates.

Pyrite is found sparingly in cubes up to quarter inch in size on calcite, milky quartz, dolomite and serpentine and massive as veins in the same minerals and as coatings on various minerals.

Pyroxene-coccolite is plentiful as round dark green grains in limestone, frequently with red and yellow grains of chondrodite.

Pyrrhotite is very common in pure masses associated with clinochlore, chalcopyrite, actionolite, tremolite, dolomite, etc. The brown, tabular hexagonal crystals as displayed in the American Museum of Natural History are scarce. I have found a good crystal, one inch long by a half inch wide, terminating a vein of massive pyrrhotite in dolomite.

Quartz. As mentioned before the only quartz at Tilly Foster in quantity is milky, generally in loose pieces of good quality.

Serpentine. This is the most common and conspicuous mineral on the dumps, in large and small masses, white, gray, brown, black, and green of many shades. The red, reported by Mr. Whitlock, is hard to find today. Good "slickensided" serpentine, formed by slides is very common.

Spinel. F. R. Koeberlin mentions spinel in an article published in Economic Geology in 1919 as a constituent of the Tilly Foster iron ore with magnetite, serpentine and chondrodite. It occurs also in tiny well formed black crystals, with grains of chondrodite in calcite; in fact, it is quite common.

Stilbite. brown, in gneiss, according to Mr. Whitlock but I have not heard of any being found in recent years.

Talc is uncommon, contrary to expectations. I have a specimen 4 x 3 x 3 inches on 'yellow ore", apple green with pearly lustre, curved columnar.

Titanite (sphene). This is one of the minerals for which Tilly Foster is famous. Beautiful specimens can be seen in the Canfield collection in the National Museum and in the American Museum of Natural History, in transparent to translucent greenish and yellow crystals, sometimes two inches long, often twinned and modified, with magnetite and apatite in gneiss and in matrices consisting of a mixture of magnetite, ripidolite, chlorite, amphibole and calcite. Such crystals are hard to get; they are "antiques" and probably cannot be found on the dumps today. They were found originally in pockets. One group went into the Canfield collection and another group, found in 1891, was sold by George L. English. Handsome gems were cut from the clear material. Many collectors in recent years, looking for titanite at Tilly Foster have been disappointed. In 1926, Mr. Elwell found a half inch crystal, pale brown, with sharp edges and good quality in serpentine. In 1936, Dr. Pough found a quarter inch yellow crystal imbedded in albite which he was good enough to give to me and Mr. Yedlin recently found a small specimen. Small brown crystals in microcline have been found in recent years.

Tourmaline is occasionally found in lustrous black crystals in gneiss, calcite, brownish pink clay and in massive tourmaline. It has also been found as brownish crystals on calcite with actinolite

Pseudomorphs

Brucite after dolomite, in foliated forms, reported by J. D. Dana in 1874 but not found recently according to the records.

Dolomite after chondrodite crystals; same comment.

Calcite after aragonite; same comment.

Magnetite after chondrodite and **dolomite;** same comment.

Pyrrhotite, after **serpentine**, in plates; same comment.

Serpentine after amphibole-hornblende can be found occasionally today in masses.

Serpentine after anhydrite (?) J. D. Dana, in 1874 listed this as number eleven among the pseudomorphs after serpentine and described it as "rectangular plates or tables after an unknown mineral". Although it was and still is suggested as after anhydrite, he argues against it. There are no reports that it has been found in recent years or that anhydrite itself has ever been found. I have a purchased specimen.

Serpentine after apatite reported by J. D. Dana as dark green plates 3 or 4 inches cubic serpentine after periclase (?) described below, often with small crystals of magnetite and clinochlore. Not reported in recent years.

Serpentine after biotite, reported by J. D.

Dana as dark green plates 3 or 4 inches in width. It may be at Tilly Foster today but is difficult to identify.

Serpentine after brucite, reported by J. D. Dana, as of fibrous structure. Difficult to find today.

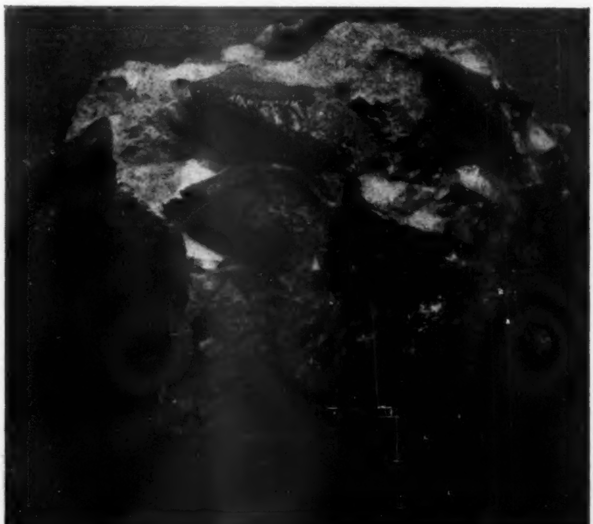
Serpentine after calcite, "probably", says J. D. Dana, as hexagonal prisms, imbedded in what Clifford Frondel calls colloidal serpentine. I have never found it.

Serpentine after clinochlore (a chlorite), in plates, clusters of divergent folia and masses, according to J. D. Dana. This can occasionally be found today. The serpentine in my specimen is variety bowenite.

Serpentine after chondrodite is rather rare in crystals but abundant in masses. No mineral at Tilly Foster is altered as much as Chondrodite. In masses it is bluish and fragile and the "blue ore" of the mining days is the "yellow ore" with the chondrodite altered to serpentine as mentioned above. The first stage of the alteration of the garnet red crystals is reddish brown and these can be found today; the next stage is gray to smoky blue and finally dark green.

Serpentine after dolomite, reported by J. D. Dana, as apple green rhombohedrons, with the interiors often unaltered. Very seldom found. You can however find dolomite in the process of alteration along cleavage joints, often in needle like forms penetrating the dolomite in all directions. I have a handsome specimen of a rhomb 2½ x 3 inches which was purchased.

Serpentine after enstatite. Clifford Frondel describes a long thin tabular crystal of serpentine after enstatite in the American Museum of Natural History. I have a fine apple green cleavage, 3 x 5 inches, which was purchased and have found other but poorer specimens on the dumps



SERPENTINE PREUDOMORPH
AFTER CHONDRODITE
Tilly Foster, N. Y.
(J. N. Trainer Collection)

Serpentine after periclase (?) The most studied and discussed of all the Tilly Foster pseudomorphs after serpentine was for many years classed as after an unknown mineral and called "cubic antigorite". In 1874, J. D. Dana who reported and described it, had a theory that the original mineral changed first to dolomite and then to serpentine. In the early Nineties, Tschermak suggested that the original mineral was Periclase and later (1903 and 1904) Axel Hamberg and Otto Mugge came to the same conclusion, but in all lists, including Clifford Frondel's, there is a question mark after the word periclase. Apparently the evidence is not yet all in. I have eighteen specimens, two thirds of which I picked up myself; in varying shades of dull and bright green, with different lusters and in different matrices. Periclase, itself, like anhydrite, has not been found at Tilly Foster; perhaps it has **all** been altered to the aggressive serpentine.

Here is an interesting experience illustrating the difficulty of identifying pseudomorphs. I bought a specimen labelled "serpentine after an unknown mineral". The first mineralogist I showed it to said it was after brucite; the second that it was brucite itself; and the third that it was after pyrophyllite. When they differ like that, one must go on asking questions. In form it does resemble pyrophyllite. It also resembles brucite in forms from other localities but not in any form so far found at Tilly Foster. It is not mentioned by J. D. Dana in his original list.

In my Tilly Foster collection, I have 43 of the 55 species, 15 of the 19 varieties and 17 of the 27 pseudomorphs which is not bad for three years of collecting. Many of them can be called fine specimens. I hope in time to get most (but not quite all) of those lacking.

SERPENTINE PSEUDOMORPH AFTER PERICLASE (?)
Tilly Foster, N. Y.
(J. N. Trainer Collection)

In the preparation of this paper, acknowledgements are due Mr. Whitlock and Dr. Pough at the American Museum of Natural History, Mr. George E. Ashby, Mr. Leo N. Yedlin and other members of the New York Mineralogical Club, Mr. Ralph E. Morgan, owner of the mine, and the superintendent of the crushing plant who calls me "Pop" and worries about me at the blasting hour. Dr. H. Berman rendered valuable assistance in identifying the diopside.

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BIBLIOGRAPHICAL NOTES

Copper Mining in North America: by E. D. Gardner, C. N. Johnson, and B. S. Butler—300 pp., 92 figs. and illus.

Copper is the most important nonferrous metal mined in America and the United tSates is one of the world's greatest producers. In the bulletin are assembled and summarized many subjects relating to the copper industry in North America. Production of mines and districts, history of the industry, geology of the principal deposits, and mining methods and costs are discussed. The principal copper mines of the continent are listed and pertinent data regarding their operations tabulated. Issued by the U. S. Bureau of Mines as Bulletin 405. For sale by the Superintendent of Documents, Washington, D.C.—price 40c.

Minerals Year Book 1938: Compiled under the supervision of H. Herbert Hughes—1339 pages.

The volume presents an economic and statistical review of developments in the mineral industry in 1937 not only in the United States but in most of the foreign countries as well. Issued by the U.S. Bureau of Mines and for sale by the Superintendent of Documents, Washington, D.C.—price $2.00 (cloth).

Slicing and Polishing Meteorites: In the Sept. 1938 issue of SCIENTIFIC AMERICAN, Albert G. Ingalls had an interesting one page article with four illustrations on slicing and polishing meteorites. The article is recommended to our amateur lapidaries.

A NEW OCCURRENCE OF MILLERITE — FURTHER NOTES ON THE SULLIVAN TRAIL COAL CO.

By M. ALLEN NORTHUP

In the January, 1937, issue of ROCKS and MINERALS, the author[1] described various minerals found at West Pittston, Pa., especially at the Sullivan Trail Coal Co. mine. He reported then that no Millerite, the mono-sulfide of nickel, was found there, although a thorough search was made. However, on revisiting the locality some months later (May, 1937), not only Millerite, but several other new minerals were found in fair abundance. This improvement in the locality was due to the presence on the culm heap of a great deal of fresh rock taken out in deepening the shaft. As this rock had not passed through the crushers and hydraulic cones in the breaker, it was in almost its original condition and the associated minerals hadn't been damaged. It also seems to have come from a different and more mineralized formation than any of the rock previously examined.

Another reason for the author's not finding any Millerite formerly may have been that he was looking for it in clay-ironstone concretions, having read that it occurs that way. This was a great mistake. The collector should look for neither concretions nor Millerite, but for veins in slate filled with Quartz or Ankerite crystals. On cracking these open, if he is lucky, he will find little tufts of pale brass-yellow Millerite fibers in spaces between the crystals.

Although fairly abundant, the tufts are small, varying from 1/16" to ½" in length depending on the free space available. The number of fibers in a group also varies from a few widely separated ones to close packed bunches of numerous individuals. Rarely, a tuft of short fibers branches out of the tip of a longer single one, and once in a while a specimen is found with a characteristic greenish gray tarnish. A single example of Millerite having tiny Pyrite crystals strung on the fibers like beads was found on Quartz at a nearby mine.

The Quartz and Ankerite crystals upon which the Millerite occurs are found in transverse veins in profusely faulted black coal-measures slate. They usually have a layer of small rhombic crystals of Ankerite next to the rock on both sides, with more or less Quartz in the openings of the wider ones. Generally there is some crystallization of the Quartz leaving angular cavities between the faces, even if the vein is filled almost completely. The best Millerite occurs here.

Since Millerite occurs either on Quartz or Ankerite, or both, and has not been found at this locality penetrating either one, the order of deposition is: Ankerite, Quartz, Millerite.

As far as the author knows this occurrence of Millerite has not been previously reported. He was only able to find one reference[2] to the mineral having been found anywhere in the region, and that was a questionable occurrence with Quartz in Siderite, presumably at a coal mine in Scranton, Pa., some 9 miles east of the new locality.

It is interesting to note that Howarth[3] in describing Millerite from the South Wales coal fields, states that the mineral is generally found in cavities in clay-ironstone concretions. Although such nodules are abundant on the culm heap at the Sullivan Trail mine and contain similar accessory minerals to those mentioned by Howarth, no Millerite has been found in them. The reason for this has not been determined, though the evidence at hand suggests that the concretions came from a different, and probably higher, geological level than the Millerite-containing rocks, the two strata being separated by one or more coal veins. In other words, Millerite probably occurs only in the lowest levels of this mine.

The following other minerals were also found at this locality recently:

Sphalerite: Dark brown grains and tiny

triangular crystals occur sparingly in cavities in clay-ironstone concretions; also in slate with Quartz and Millerite, and in Pyrophyllite. Often several minute crystals form around a grain of Chalcopyrite.

Pyrite: In abundant masses of various forms, notably as flattened concretions up to a foot or more in area in slate. Some have an oval cross section, are elongated, and have spatula shaped ends. All of them are composed of very fine granular Pyrite mixed with carbonaceous matter. Sometimes they show longitudinal cracks spreading out radially from a central axis. When very flat, they have little concentric ridges around the edges, showing that they were squeezed down from their original thickness. These last have a layer of well-formed, but tiny crystals on one side. As such slabs are always close to one or more fault lines, it looks as if not only the flattening, but crystallization as well, was brought about by intense pressure caused by movements of the rock along these faults. They make very showy specimens if one has the patience to pry the slate off and clean them up.

Barite: Translucent whitish cleavage masses, seldom more than an inch across, in clay-ironstone concretions.

Pyrophyllite: White, very fine granular masses filling narrow fault or strain cracks in slate, often running diagonally across the main cleavage of the rock; and varying in thickness from ¼" down to a mere film. Some specimens are solid and break out cleanly from the slate, while others are gouged and grooved as though rock movements had taken place along the vein after the mineral was deposited. Due to its softness and "slip", it would make a good lubricant for such movements. The mineral has been reported[4] from collieries at Drifton, Gowen, and Mahoney City, Pa., but as far as the author knows, not from the neighborhood of West Pittston.

Chlorite: Tiny green to brown scales in booklets attached by their edges to the walls of cracks or cavities in slate are probably one of the Chlorites. As a determination of optical properties would be required to establish the exact identity of the mineral, this cannot be given. One specimen of Chlorite was found included in little Quartz crystals, giving them a nice dark green color.

Literature References:-

[1] "The Minerals of West Pittstown, Pa." by M. Allen Northup; ROCKS and MINERALS, Vol. 12, No. 1, P. 18 (Jan. 1937).

[2] "The Mineralogy of Pennsylvania" by S. G. Gordon:- Special publication No. 1 of the Philadelphia Academy of Natural Sciences: cf. "Millerite" also, "Lackawanna County."

[3] "Millerite" by W. E. Howarth; ROCKS and MINERALS, Vol. 5, No. 1, P. 3 (March, 1930).

4. See No. 2 above:- P. 127.

New Feldspar Locality In California

Mr. W. Scott Lewis, Hollywood mineralogist, has announced the discovery of a new locality for feldspar crystals on the summit of a ridge of the Sierra Nevada Mts. at an elevation of about 11,000 feet. It may be reached by taking the Rim Trail from Lake George in the Mammoth Lake Basin, Mono Co. When the red cinder cone at the summit is reached the collector should turn to the right and search along the top of the high palisades. Loose orthoclase crystals are scattered for a distance of about a mile and Carlsbad twins may be found, although they are usually not in good condition.

Dr. H. C. Dake, one of the authors of **Quartz Family Minerals**, and William T. Baxter, author of **Jewelry, Gem Cutting and Metalcraft**, both report heavy sales of their books.

Another book which is in keen demand is **Mineral Tables for the determination of minerals by their physical proterties** by Arthur S. Eakle whose third edition has been revised by Adolf Pabst.

These three books, all recent editions, should be in the mineralogical library of every collector. Are they in yours?

THE COOBER PEDY OPAL FIELDS, AUSTRALIA

BY GEO. BURFORD

The Coober Pedy opal fields were discovered in 1915, just about the time that the famous White Cliffs fields became worked out. The Coober Pedy field is a huge one, compared with all other known opal fields, as it extends along the Stuart Range for over 40 miles. The population has varied from 400 odd down to 60 odd during the years following its discovery.

About 90% of the present world's output of opals comes from this quaint little town. The town is situated in about the centre of the workings Parties go out for a distance of 20-odd miles, north, and the same distance south. Owing to the intense heat and also fly trouble, together with the high cost of building materials, the gougers (as the opal miners are called) have resorted to underground dugouts for residences. Some of these residences are quite picturesque and cozy, consisting of several rooms with stoves, desks, wireless, etc., etc.

The field is situated on the edge of a vast desert in the center of South Australia which extends right into Western Australia. It is possible to travel either west or north for thousands of miles without meeting a fence of any kind.

The water supply around which the township is built (or shall we say dug) is a catchment area of several miles with a huge underground concrete tank.

The main road from Adelaide to Darwin now proceeds through Coober Pedy. This was made possible by the construction of the tank. There are no permanent waters within hundreds of miles of Coober Pedy. A weekly mail service runs from the East West line to Coober Pedy which also brings stores and provisions. The prospectors from outlying camps all meet at week ends for their stores, water, and also to dispose of the opals found.

The writer, who became associated with the field immediately after the Great War, has seen the field advance from a mere handful of tough pioneers to the boom days of a few years ago. In the early days, camel transport was the only means of moving about. It took over a fortnight to reach Coober Pedy from Adelaide. Today it is a one and a half day's journey, via an express train or motor rail.

It was necessary for a party to convey all their requirements from the rail head for a trip lasting until the surface waters dried up. Then away until another rain occurred. Thus the living was rough with water a most valuable asset that was used very sparingly. The diggers had to make hay while the sun shone. Everyone had to be a cook, bootmaker, camel man, pick and tool sharpener, doctor, etc., etc. The rewards in the way of big finds were sufficient to entice the same parties, time and time again. The loss of the camels in this unfenced desolute country could have been fatal. Today with wireless, stores, post office and travellers continually passing through, the field has become almost next door to a metropolis. There is even a bank in Coober Pedy which is conducted by the writer (The Commonwealth Bank).

The post office, which of course is also underground, is becoming widely known throughout the world. Requests for envelopes, stamped with the Coober Pedy date stamp, are received quite regularly. The philatelists have discovered that it is the only underground post office in the world.

Some wonderfully rich finds have been made at times. One claim, measuring less than 150 x 150 feet, produced £25,000 worth of opals—a world's record. A wealth of fossils, shells, opalized wood, etc., has been found and despatched to museums all over the world.

The writer packed a most wonderful collection of fossils, gems, shells, etc. for display by The Commonwealth Government at the American Fairs next year. It includes a huge piece of opalized wood about 14" long and 3" in diameter. The core and knots in the wood are clearly defined. A large flat stone of first class opal is also included. The stone is about 8" long and about 3½" wide. All members attending the exhibitions will be well rewarded if they look up these exhibits. Some of the fossils are world beaters. One expects to see the world's best at an exhibition and they will see the goods in this instance.

PLATINUM METALS IN A COLORADO COPPER DEPOSIT

The finding of appreciable amounts of platinum and palladium in a promising deposit of copper ore in southwestern Colorado is announced by the Geological Survey, United States Department of the Interior. The platinum metals were found by E. T. Erickson during a laboratory study of ores collected by Edwin B. Eckel, who is studying the ore deposits of the La Plata mining district as a part of the co-operative program that has been carried on since 1926 by the State of Colorado and the Federal Survey. Since its discovery in 1873, the La Plata district has produced nearly $6,000,000 worth of gold and silver, but very little copper.

The platinum-bearing copper deposit lies on Copper Hill, between Bedrock and Boren Creeks, at an altitude of 10,250 feet, about half a mile from the old town of La Plata and 21 miles northwest of Durango. The workings of the Copper Hill mine include a glory hole, or open cut, and a 600-foot tunnel. Between 1911 and 1917, the mine yielded 2,300 tons of ore, which contained about 4,500 ounces of silver and about 225,000 pounds of copper. It has been idle since 1917.

The Copper deposit lies near the edge of a large mass of the igneous rock syenite, through which are disseminated chalcopyrite, the chief ore mineral of copper, and other metallic minerals. Chalcopyrite also occurs as small irregular veinlets and lenses. Of two picked samples of relatively high grade copper ore from the dump of the mine, assayed by the Geological Survey chemist, one contained 17.6 per cent of copper and 0.54 ounce of platinum metals to the ton, and the other contained 13.1 per cent of copper and 0.26 ounce of platinum metals to the ton. The amounts of platinum and palladium are nearly equal, and a little silver is also present. Mr. Eckel points out that these samples represent the grade of ore that could probably be picked out by careful hand sorting and are by no means representative of the ore deposit as a whole. They prove, however, that the copper ore contains appreciable quantities of precious metals. Careful estimates of all known factors lead Mr. Eckel to believe that the crude ore in place will probably assay about as follows: Copper, 2-4 per cent; platinum, 0.02-0.06 ounce per ton; palladium, 0.02-0.04 ounce per ton; silver, 0.14-0.76 ounce per ton.

As much of the more promising area is covered with soil and with the debris of an ancient glacier, it is impossible to make a reliable estimate of the size of the ore body. Exposure in and near the mine indicate that it is at least 150 feet in diameter and 50 feet deep. Only further exploration, such as by diamond drilling, will show whether the ore below the glory hole is rich or poor.

All the samples collected from several nearby copper deposits contained less copper than the deposit on Copper Hill, and none contained platinum. Geologic conditions are so similar, however, and exposures are so poor that the entire area in and near the syenite masses in the central part of the La Plata district seems to warrant thorough examination. Most of the promising ground is public land and is open for location.

Details of the findings will be presented in an illustrated paper by Mr. Eckel, entitled "Copper deposits of the La Plata district, Colo., and their platinum content," soon to be published by the Colorado Scientific Society, at Denver, Colo.

President Doherty In South America

R. Emmet Doherty, President of the Rocks and Minerals Association, is somewheres in the wilds of Venezuela, hunting rocks, minerals, gems and adventure. It has been months since we had a letter from him so that his whereabouts is not known nor what he is doing. Someday he will turn up with his pockets full of diamonds and a trunkful of wonderful minerals.

TWO WEEKS

THAT IS ALL THE TIME LEFT BEFORE THE CLOSING OF THE PRIZE ARTICLE CONTEST.

Great things have been accomplished even in lesser time but do not delay sending in your manuscript. If your article is not written as yet do it NOW. What if you lose? You have at least made a beginning. And you might win one or other of the three prizes.

The rules of the contest are:

Articles must deal with some mineralogical subject with emphasis on popular appeal and general interest but with some scientific aspect included. For instance, if a locality is described, something of the occurrence as well as a description of the minerals present should be treated. Photos, maps, etc. are not necessary but could serve to make an article more interesting. These should be in shape for publication. All maps, drawing and sketches should be in black ink.

Articles must be typewritten (keep a carbon copy for your files) from 4,000 to 6,000 words in length, and as each will be judged anonymously, the author's name should not appear on it. Have two title pages for each article. On the first type the name of the article and your name and address; on the second title page type only the name of the article. All articles must be submitted by or before midnight of October 15, 1938.

Address them to

PRIZE ARTICLE CONTEST,
ROCKS and MINERALS,
PEEKSKILL, N. Y.

All entrants must be members of the Rocks and Minerals Association.

No article will be returned (if not a prize winner) unless a self-addressed stamped envelope is enclosed with it. Furthermore all articles submitted in the contest will be held subject for possible publication in **Rocks and Minerals.**

The judges in the contest are: Dr. Frederick H. Pough of the American Museum of Natural History, O. Ivan Lee, and Arthur Montgomery, all of New York City.

The prize-winning articles will be announced in the January, 1939, issue of **Rock and Minerals** and published in the early issues of that year.

Other than that the articles should be addressed to **Rocks and Minerals,** this magazine has nothing to do with the running of the contest. All such mail as is addressed to the Prize Article Contest will be turned over to the judges.

WITH OUR MEMBERS

C. M. Allen of Hamilton, Bermuda, is spending a three months vacation in the United States. A long motor tour through the West, with rock hunting on the side, is on his itinerary.

A. C. Carpenter of Ottowa, Kansas, reports a most pleasant trip through the West and through Alaska made during the summer. Few specimens were collected in Alaska but many good ones were obtained in Montana and Wyoming.

Mr. and Mrs. W. T. Baxter of Washington, D.C., covered 10,000 miles this summer on their trip to the West Coast during which many geological and mineralogical localities were visited.

Mrs. Grace S. Beckwith of Cambridge, Mass., who had been touring Alaska this summer, crossed the Arctic Circle at 4:00 A.M., July 31st. At the time the Circle was crossed, she was aboard the S. S. Yukon.

FOSSILS AND FOSSIL COLLECTING

By IRVING G. REIMANN
Curator of Geology, Buffalo Museum of Science

Part V. Petrifaction by "Molecular" Replacement

Many beautiful fossils are found in which the microstructure is preserved but which bear no trace of their original chemical composition. Such occurrences are true pseudomorphs in the best mineralogical sense.

The best known of the petrified woods have been completely replaced by silica with such nicety of detail that the microstructure can still be accurately determined on polished thin sections. The famous specimens from Adamana, Arizona; Yellowstone National Park; Fossil Cycad National Monument, South Dakota; and Oregon are familiar examples to be found in almost every collector's cabinet.

This remarkable method of preservation, without which we should have but little detailed knowledge of the structure of ancient plants, is called metasomatosis, or metasomatic replacement. It is sometimes described as a molecule-by-molecule replacement of the original material by the replacing agent. That is, as a molecule of the original material is dissolved or decays, it is replaced by a molecule of the new mineral which is present in a saturated solution and in some instance is aided in its deposition by carbon dioxide. This process might more properly be spoken of as a particle-by-particle replacement, since molecules of different substances have different sizes. A molecule-by-molecule replacement would imply an expanding or shrinking, and this is not observed to be true. A thousand grapes would not occupy as much space as a thousand oranges, and neither would a number of molecules of one substance occupy the same amount of space as the same number of molecules of another substance.

In the silicification of wood, colloidal silica in underground water coming in contact with the carbon dioxide given off by decay of the wood is precipitated as a solid. This changes eventually into chalcedony. When metallic oxides are enclosed in the silica, beautiful and varied colors are often given to the petrified wood. Perhaps the most beautifully colored specimens are those from the Petrified Forest of Arizona.

Silica, while one of the most stable of the minerals, is soluble in minute quantities in pure water, but water containing alkalies leached from the soil is a more efficient solvent. The silica which replaces wood, and sometimes shells and bones, is usually derived from the enclosing strata, although occasionally uprising thermal waters may be the source.

Shells in limestone are frequently silicified on weathered surfaces. The silification may extend through the entire stratum, but not infrequently shells may be found with the projecting weathered portions silicified but with the buried and protected remainder retaining its original calcareous composition.

In addition to silica, calcite, marcasite, and pyrite are the most common replacing minerals. Silicious sponges may be replaced by calcite; calcareous shells by marcasite or silica; wood and the chitinous shells of arthropods may be replaced by silica, calcite, or marcasite; and so on in endless variety. The circumstances determining the alteration depend upon the character of the material being replaced, upon the richness of the underground water in that mineral, and upon the degree of concentration of other minerals in the underground water. For example, water poor in calcite but rich in silica will tend to dissolve calcareous fossils and replace the calcite with silica.

It is apparent that the present substance of a fossil is often a poor guide to its original composition. The confusion, however, is more apparent than real, since the original composition can be accurately inferred by a comparison with that of its living relatives. Wood is composed chiefly of cellulose, and there is no reason to believe that the

ancient relatives of existing trees were constituted differently and much evidence that it was the same; (e. g., carbonized fossil wood). Brachiopods, except those with phosphatic shells, build their shells of calcite. Molluscs use both calcite and aragonite, of which calcite is the more stable. Shells of aragonite, except under the most favorable conditions, are generally dissolved, frequently before there is opportunity for replacement. Some corals use aragonite for their skeleton, while others use calcite. Different sponges use silica, or chitin.

These instances described above are intended merely to serve as examples or illustrations of this interesting process. There are many more minerals, among which may be mentioned sphalerite, malachite, hematite, opal, and selenite, which under favorable circumstances may replace fossils.

Fossil collectors have frequent occasion to rejoice over nature's quirks in changing the composition of her children. Hard limestones commonly cling strongly to their contained fossils, and even the most careful splitting and chiseling often yields the collector little but chips and dust and broken fossils or shells adhering to the matrix. What a happy find it is to stumble onto a weathered outcrop of such a formation with beautiful silicified shells waiting to be collected with no greater expenditure of time or effort than to pick them up. Or if there is no well-weathered outcrop, limestone with silicified fossils yields up its contents to hydrochloric acid. One investigator, by dissolving a cubic foot of an apparently not very fossiliferous limestone, was rewarded with more than fifteen thousand shells! Had these shells not had their original calcite replaced by silica, only laborious mechanical methods would have extracted them, and then only comparatively few would have been recovered.

THE AMATEUR LAPIDARY

Amateur and professional lapidaries are cordially invited to submit contributions and so make this department of interest to all

PICTURE MINERALS

We know of a collector who specializes in "picture minerals". A "picture mineral" is one which resembles or which contains markings that resemble landscapes, seascapes, trees, ferns, animals, birds, men, or any other forms. Some of these markings are very realistic and are especially prevalent in agates—hence "picture agates".

The markings appear at their best when present on polished surfaces. Consequently when the surface or a section of a mineral is polished, the polished face should be carefully examined for a "picture".

Collectors would do well to examine all their polished specimens to see how many "picture minerals" may be found.

COARSE GRAVEL

By E. A. SOUTHWICK

Dode Moroni is so dumb she thinks antimony is what a divorcee gets from her ex-husband.

An optimist is a fellow who expects a picture in every agate he finds or buys.

A guy I like
Is Rockne Lee;
He always loans
His pick to me.

An old-timer is one who can remember when prospectors traveled by burro instead of by auto.

Lafe Scroggins ain't feelin' so good. He says he thinks he's got plumbago.

No, Ruby dear, you can't get rock and rye at a gravel bar.

A Kansas collector named Fox
Went out in the field to hunt rox.
He sat on some ants
They got in his pants.
He even got some in his sox.

The honeymoon is over when he leaves her at home and goes out looking for mineral specimens.

If all the collectors of rocks and minerals were placed end to end they might reach to the moon, and every one of them would want to knock off a chunk for his collection.

Gneiss baby. Itt et up all de poppa's halite crystals.

A Gift From Japan

Mr. Wm. Ambrose, a member residing in Yokohama, Japan, presented the Editor of ROCKS and MINERALS with a copy of "Notes on the minerals of Japan."

This very interesting bulletin, written in English by Kotora Jimbo, Professor of Mineralogy, Imperial University of Tokyo and published in Japan in 1899, has long since been exhausted. It consists of 69 pages and describes briefly 128 minerals with their important localities. A publication we have never seen before, it is a great pleasure in adding this valuable bulletin to our mineralogical library, Will Mr. Ambrose please accept the Editor's grateful thanks?

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The natural method of identifying minerals is by using those characters which are prominent or which can be determined in the field or laboratory in the simplest manner. Practice in the determination of minerals by their physical properties tends to develop the habit of close and careful observation and at the same time enables the student to acquire more knowledge of minerals in a given time than he could obtain by any other method. Experience has demonstrated that work in blowpipe analysis is less likely to become merely mechanical if it has been preceded by such practice as is afforded by the use of this book.

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